942,630

PATENT SPECIFICATION

DRAWINGS ATTACHED

942,630

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Date of Application and filing Complete Specification
February 20, 1962.
No. 6525/62.
Complete Specification Published November 27, 1963.

Index at Acceptance: Class **F4**, R(5C8H1:5C18C).
International Classification: **F 21 b.**

Downlight and device for varying the spectral quality thereof.

COMPLETE SPECIFICATION

We, CENTURY LIGHTING, INC., a corporation organised and existing under the laws of the State of New York, of 521 West 43rd Street, New York 36, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:

This invention relates to a downlight and to a device for varying the spectral quality thereof.

A downlight is an electric lighting fixture which is mounted in a concealed overhead position, as for instance in a ceiling, and has associated therewith an incandescent filament type light bulb and a reflector for increasing the downward lighting efficiency of said bulb.

Although downlights are highly desirable and widely used because they illuminate objects beneath them without taking up the space or requiring the cleaning that exposed fixtures do, they have several drawbacks. For instance, since a downlight is concealed within, i.e., above a ceiling, there is a great contrast in brightness between the spaces around the lights and the objects beneath the lights which gives rise to a gloomy effect at the upper part of a room. Moreover, it is customary to equip downlights with uncolored light bulbs, that is to say, light bulbs having either clear envelopes or white, frosted envelopes, so that the light cast thereby is practically white, i.e. a very light yellow (white will hereinafter be considered to be the color quality of an incandescent filament at a temperature between 2700° and 3200°K) inasmuch as this will yield the most desired illumination of objects beneath the same. However, this strong white beam at the ceiling very often is undesirable for the decor of a room or space. If the downlight is so constructed as to increase the illumination near the ceiling, the presence of a white light at such a high level creates a stark unattractive appearance. Moreover, throwing strong white light from the fixture at such an angle as to decrease the gloom over the ceiling will distract passers by since light emanating from a ceiling fixture at an angle less than 45° to the horizontal is within the normal range of vision of a person in the room.

It has been proposed, in order to avoid the foregoing difficulties, to incorporate a colored lens or filter in a downlight. This, however, has the drawback that it prevents white light from being cast on the object to be illuminated and does not notably relieve the gloomy appearance of the ceiling. It also has been proposed to employ a colored envelope for the lamp bulb but this, too, varies the desired spectral quality of the light cast on the object below. Finally, it has been proposed to color the reflector. This does not alter the spectral quality of the unreflected light directed downwardly, but it does affect the spectral quality of reflected light and thus creates an eerie result.

It is an object of the present invention to provide a downlight which avoids all of the foregoing difficulties and which, nevertheless, includes very few additional parts and, therefore, is only slightly more expensive.

It is another object of our invention to provide a downlight of the character described in which the spectral quality of the direct and reflected strong light that is cast on an object beneath the same is not altered, that is to say, is white, but further in which weak light beams of an other than white spectral quality are cast at less than 45° to the horizontal so as to relieve the gloom now present in the area of the ceiling.

It is another object of our invention to provide a downlight of the character described which has an unusual and attractive decor in that the weak high-level secondary illumination is of a spectral

(Price 4s. 6d.)

quality other than white, so that the ceiling and walls of a room are softly illuminated in a desired color and yet the object which is to be lit by the downlight is strongly bathed in white light.

It is another object of our invention to provide a downlight of the character described which has an uncolored bulb and reflector and yet which, when viewed by a passerby at an oblique angle, will appear to be other than white.

It is another object of our invention to provide a downlight having all of the foregoing desirable attributes and yet which has neither a colored bulb nor a colored reflector.

It is another object of our invention to provide a downlight of the character described in which the spectral quality of the secondary illumination can quickly and easily be varied at will to give any desired color-accenting decorative effect.

Other objects of this invention will in part be obvious and in part will be pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention,

Fig. 1 is a schematic elevational view of an enclosed space, such as a room provided with downlights constructed in accordance with our invention; and

Fig. 2 is a perspective view through one such downlight.

Referring now in detail to the drawings, the reference numeral 10 denotes a downlight constructed in accordance with our invention. Said downlight includes a reflector 12, i.e., a hollow body, which provides a surface of revolution with a downwardly facing opening and the interior surface of which preferably is specular or semi-specular and as illustrated is specular. A typical suitable material for this purpose is aluminum having, for instance, a polished interior surface. The specific contour of the reflector will be described hereinafter. The upper end of the reflector is interrupted to provide an opening 14 from which an erect tubular sleeve 16 integrally extends. The top of said tubular sleeve has mounted thereon an outlet box 18 in which there is secured a standard electric socket 20 adapted to hold therein an incandescent electric light bulb 22. A conduit 24 connected to the box is provided to pass a pair of electric wires 26 that supply energy to the bulb. The envelope of the bulb may be either clear or frosted, and in the form illustrated is frosted.

In general, the contour of the reflector is such, as is well known, that all rays of light incident thereon will be cast in a generally downward direction. The particular reflector shown has a contour such that any ray of light emanating tangential to the surface of the frosted envelope of the bulb will be principally reflected downwardly at an angle of 45° to the horizontal as indicated at A. Within this cone light is nicely diffused either by utilizing a frosted bulb in combination with a specular reflector or a clear bulb in combination with a semi-specular reflector. This particular 45° angle is arbitrarily chosen because it has been determined experimentally that a passerby, unless his attention is distracted, ordinarily will not be annoyed by any bright object high on the azimuth. 45° is best for this purpose; however, we contemplate the use of angles as great as 60°. Accordingly, with the reflector construction described, any ray of light emanating from the bulb and striking the reflector usually will not be observed by a passerby. It will be apparent that if the tangential rays of light emanating from the bulb are reflected principally at an angle of 45°, all other rays of light emanating from the bulb and striking the reflector will be directed downwardly at a steeper angle so that they will not ordinarily be noticed by a person in the room below the light.

The downlight is mounted in a ceiling 28 and has its lower end located in an opening 30 therethrough. The downlight can be secured in said opening in any suitable manner. For instance, we may provide a set of mounting tabs 32, e.g., four such tabs, equiangularly spaced around said opening and embedded in the plaster of the ceiling. Each of the tabs has secured thereto as by welding, an L-ring 34 having one leg vertical and flush with the opening in the ceiling and the other leg horizontal and slightly above the exposed ceiling surface. The reflector portion of the reflector 12 terminates at 36 a short distance above the ceiling line. From this lower termination zone 36 to the ceiling line the reflector is of any arbitrary downwardly extending shape inasmuch as, as soon will be seen, this portion does not function as a reflector. The lower end of the reflector is provided with an outwardly protruding annular bead 38. To support the reflector, and therefore the downlight, from the mounting means, the vertical leg of each L-ring has secured thereto, as by welding, a U-shaped clip 40 of resilient strip metal. The bead 38 is adapted to be disposed at the base of the U, the U being upwardly extending and the base being lowermost.

The lower rim of the reflector is concealed by a cut-off plate 42 the bottom surface of which is flush with the finished ceiling

line of the room. Said cut-off plate is secured in position as by means of screws 44 the heads of which engage the plate and are flush therewith and the shanks of which mesh with tapped bores in the horizontal legs of the L-rings. The cut-off plate has a central opening 46 through which the light emanating from the downlight passes. Said opening is concentric with the vertical central axis of the bulb and is of such size that it will cut off all light issuing from the bulb and reflector and directed downwardly at an angle less than 45° to the horizontal, except light subsequently reflected by the means for producing a secondary region of illumination as described below. In other words, a line drawn to the bulb from any point of the opening 46 and tangent to the former at a diametrically opposite point on the envelope of the bulb will be disposed at an angle of 45°. Typical cut-off lines are indicated by the reference numeral 48. It thus will be appreciated that the combined effect of the reflector and cut-off plate is to create a primary downwardly directed 90° cone of strong white light, the sides of which are quite well defined. Heretofore it has been the practice to limit illumination cast by a downlight to the aforesaid primary cone and for this purpose to employ a black sleeve inside the reflector extending downwardly from the zone 36.

Pursuant to our invention, we provide a means for creating a secondary region of illumination above and around the primary cone, said region being of a limited selectable visible spectral band, i.e. of a color other than white. The aforesaid means constitutes a member 50 which essentially comprises a multi-ring baffle the interior surface whereof is colored to provide a spectral reflectance of a limited selected visible spectral band. Typical spectral bands are 380/430, 431/470, 471/510, 511/560, 561/595, 596/630 and 631/760 millimicrons, it being understood that these ranges merely are exemplary and are not to be construed as limitative.

More particularly, the member 50 includes a cylindrical supporting ring 52 the upper end of which is adjacent the zone 36, said zone being at the intersection between the reflector and a 90° cone within and tangent to the central opening in the cut-off plate 42. The lower end of the ring 52 is at about the level of the upper side of the cut-off plate. Said ring conveniently may be fabricated of sheet metal and in effect constitutes a large-diameter squat sleeve. Projecting inwardly of the sleeve are a series of baffle plates 54, 56, 58. The baffle plates can be secured to the sleeve in any suitable manner. For instance, the sleeve can be formed with a series of vertically spaced internal annular grooves and the outer peripheries of some or all of the baffle plates can be placed in and secured as by crimping to the sleeve. The lower baffle plate may simply lie against an out-turned flange 60 at the bottom of the sleeve and be permanently attached thereto as by welding.

Each of the baffle plates provides a large central opening 62 arranged symmetrically about the vertical central axis of the electric light bulb 22 so that all of the opnings of the baffle are concentric in plan. In the preferred form of my invention, the baffle openings are progressively smaller in a downward direction; that is to say, the uppermost baffle 54 has the largest opening, the lowermost baffle 58 has the smallest opening, and the intermediate baffle 56 has an opening the size of which is intermediate that of the openings in the upper and lower baffles. Desirably, the openings vary proportionately to the spaces between the baffles so that a line drawn from the inner edge of any one of the baffle openings through the vertical axis of the reflector 12 and touching any other inner edge of another baffle opening will touch the inner edges of all the baffle openings. Moreover, it is preferred that the central opening in the cut-off plate be slightly smaller than the opening in the lowermost baffle plate.

The lowermost baffle and the entire member 50 simply rest on the ceiling plate. Inasmuch as said member fits with comparative snugness in the lower part of the reflector, there is no tendency for it to move about. However, this arrangement enables the member 50 to be easily replaced merely by removing the screws 44, dropping the cut-off plate, taking out said member and replacing it with another having a different spectral reflectance band. The inner surface of the sleeve 52 and all exposed surfaces, i.e., both upper and lower surfaces and the edge of the opening, of all the baffles except the lower surface of the lower baffle are of the same spectral reflectance band, the same having been imparted thereto in any convenient fashion, as by spraying a colored paint thereon. The finish of the baffle is not of critical importance; for example, the baffle either can be diffuse, semi-diffuse or shiny, depending upon the desired decorative effect.

When in the operation of a downlight embodying our invention the electric light bulb 22 is energized, all of the light emanating therefrom in a direction downwardly through the opening in the ceiling plate will be white. Moreover, all of the light emanating from the bulb and striking the reflector, and after leaving the reflector, passing through the opening in the cut-off plate either immediately or upon further reflection by the reflector likewise will be uncolored so that the primary cone of strong light will

be white and will bathe in white light any object disposed therebeneath. All other light emanating from the bulb or reflector either will be trapped in the sleeve 16 or will at some point in its travel strike the member 50; thus some of the light will strike the upper surfaces of the baffle plates and be reflected from there back up to the reflector after which it will eventually and at least in large part pass through the opening in the cut-off plate. Other rays of light emanating from the light bulb will strike the interior surface of the sleeve 52 and ultimately, upon further reflection in part with other surfaces of the member 50, also pass through the opening in the cut-off plate. All of these rays of light which at some point in their travel have impinged upon and been reflected from the member 50 will be colored. Moreover, these rays of light will issue from the downlight principally at an angle less than 45° to the horizontal. It will be apparent that reflection from the surface of the member 50 will vary dependant upon the specific type of finish. We have indicated in Fig. 2 at B one type of reflection this being the type created by a semi-diffusing finish in which there is diffusion of each ray of light that impinges upon any part of the surface, but the major strength of light radiating from the surface as a result of impingement of a beam of light thereon will be in the direction of a specularly reflected beam. Other light issuing from the point of impingement will be at spread angles but of lesser strength. However, regardless of the angle at which the light is reflected, it will be seen that the principal portion of the light which has been colored by impingement on the member 50 will issue from the downlight at an angle less than 45° to the horizontal.

It will be appreciated that practically all of the light which is colored is at least secondarily reflected; that is to say, it will be the result of at least two reflections against colored surfaces, so that the colored light issuing from the downlight will be comparatively soft in quality, i.e., not glaring, but rather mild, this being a desired attribute of the more nearly horizontal light rays. It will be understood, of course, that many of the reflections will be the result of tertiary or additional reflections and, therefore, will be still weaker. Moreover, the major proportion of the surface of the member 50 which can be seen by deliberate observation will be at least secondarily illuminated and, therefore, not so strongly illuminated as to create an unpleasant and distracting glare.

It also will be observed that the reflector itself will appear to be colored. This is due to the fact that unless one is deliberately staring at the reflector it will not be noticed except at an angle less than 45°, and all light issuing from the reflector at an angle of less than 45° to the horizontal is colored and mild. Moreover, since all of this light is colored, the reflector itself will seem to be colored. Indeed, what actually is seen in the reflector are images of the upper surfaces of the baffle plates and, therefore, are colored objects. This has the effect of seeming to paint the reflector with the color employed so that the glow which is present at the ceiling in the vicinity of the downlight is of the color of the spectral band utilized and not white as it is in the case of an ordinary downlight. This is true despite the fact that the light which illuminates objects beneath the downlight is as white as the light which the electric light bulb 22 is capable of casting.

The overall effect of employing several downlights 10 such as described can best be seen in Fig. 1. It will be observed that each downlight casts a primary cone 64 of strong white light downwardly within an angle of 45° to the horizontal. Moreover, due to the use of the member 50 in accordance with our invention, each downlight further creates a soft, i.e., mild, secondary region 66 of light at an angle of less than 45° to the horizontal so that near the ceiling the space between the downlights is illuminated in the desired spectral band and is not left gloomy as heretofore. Moreover, this color is of any desired spectral band despite the fact that objects beneath the downlight are illuminated with white light. It may be mentioned that some weak colored light will stray into the cone 64 of each downlight. However, this incidental colored light will be washed out and rendered unnoticeable by the intense white light in this region.

By way of example, in a downlight having a lower opening about 11-1/4″ in diameter and a cut-off plate having a 6″ opening, the opening in the lower baffle plate likewise is approximately, although slightly more than, 6″, the opening in the intermediate baffle plate is 8-1/4″, and the opening in the uppermost baffle plate is 9-1/2″. The space between the intermediate and lower baffle plates is 1-1/8″ and the space between the intermediate and upper baffle plates is 3/4 of an inch. The height of the sleeve 52 is 2-3/8″. These dimensions have been given to facilitate the understanding of my invention, and the embodiment thereof in practical commercial structures. They are not, however, intended to be a limitation upon the scope of the invention.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might

be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

WHAT WE CLAIM IS:

1. An above-the-ceiling downlight including an uncolored incandescent electric bulb and an uncolored reflector separate from the bulb and symmetrically disposed around the same and having an open lower end through which is emitted a cone of light of the spectral quality of the light radiated by the bulb, and means to support the reflector and bulb above the ceiling, the reflector being shaped principally to reflect downwardly at less than a predetermined angle all light incident thereon from the light bulb, characterized in that there is provided means for varying the spectral quality of the light issuing therefrom at an angle above said predetermined angle, said last-named means comprising a unitary assembly located in and adjacent the open end of the reflector, said assembly including a sleeve and a plurality of annular flat baffles jointly carried by the sleeve and extending inwardly thereof perpendicular to the axis of symmetry of the reflector, the lowermost baffle being arranged for disposition at substantially the ceiling line, said assembly thereby defining an opening, at least the internal surface of the sleeve, the upper surface of the lowermost baffle and the upper and lower surfaces of the remaining baffles being of a colour in a common limited visible spectral band within the range of from 380 to 760 millimicrons and thereby creating in the zone above the cone of light and below the ceiling a range of secondary illumination in a color other than white and thereby also apparently coloring the reflector as viewed within said zone, and means for rapidly detachably holding said assembly to the ceiling.

2. A downlight as set forth in claim 1, wherein a substantial portion of said reflector is visible through the opening of the assembly above the uppermost baffle and laterally outwardly of the bulb.

3. A downlight as set forth in claim 2, wherein the upper surface of the lowermost baffle and the upper and lower surfaces of the remaining baffles have a semi-diffusing finish.

4. A downlight as set forth in claim 1, wherein the means detachably holding the assembly to the ceiling is independent of the means for supporting the reflector and the bulb.

5. A downlight as set forth in claim 1, which downlight is substantially as described and as shown in the accompanying drawings.

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Sheerness: Printed for Her Majesty's Stationery Office, by Smiths Printers and Duplicators.—1963.
Published at the Patent Office, 25 Southampton Buildings, London, W.C.2., from which copies may be obtained.

942,630 COMPLETE SPECIFICATION
1 SHEET

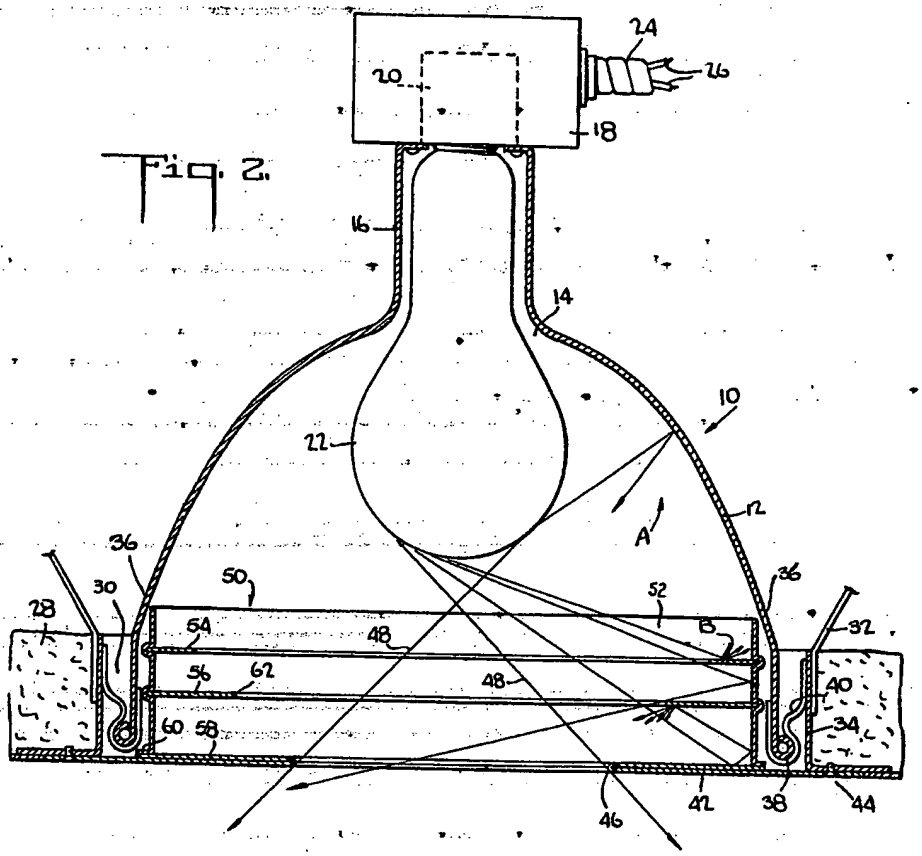

Fig. 2.

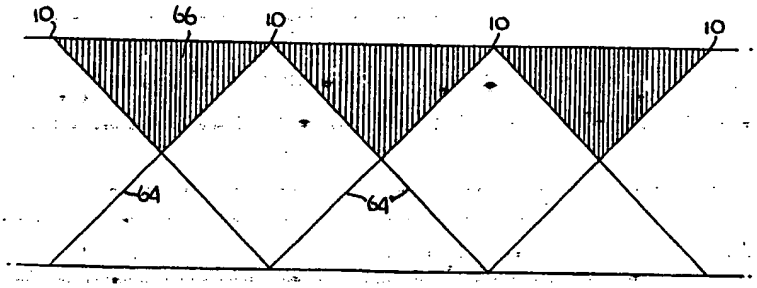

Fig. 1.